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ABSTRACT:

PURPOSE: To make the screen easy to see and reduce the power consumption by providing an automatic dimming circuit which analyzes display data and performs control so that the brightness is increased for a relatively dark gradational display or decreases for relatively bright hues.

CONSTITUTION: Two right and left fluorescent tubes which are arranged in parallel across a light guide plate are put in a semicylindrical reflecting plate and their reflected lights face the light guide plate to operate as the light source of a liquid crystal display panel. A voltage which is supplied to the fluorescent tubes is adjusted to adjust the brightness as the back light unit. The automatic dimming circuit, on the other hand, receives hue data from a personal computer as a signal source and generates a control signal for setting the brightness low for bright hues whose mean value is high over the entire surface or high for dark hues. Thus, the brightness of the back light unit is automatically adjusted corresponding to the display screen to make the screen easy to see and the brightness is suppressed for the bright screen, so the power consumption is reducible.

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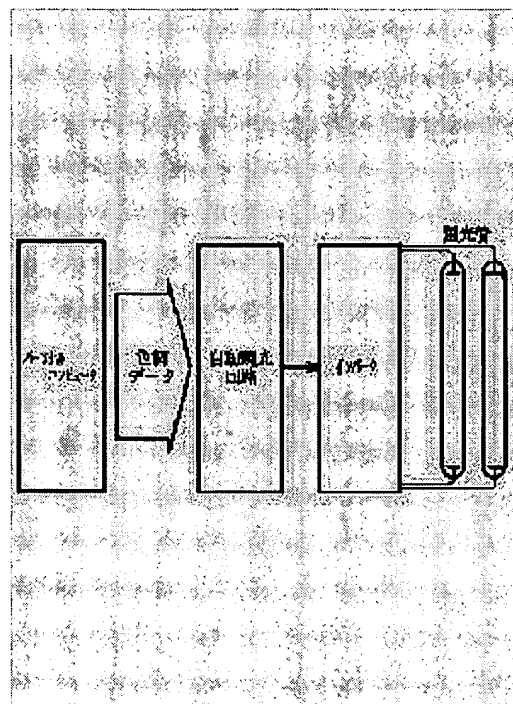
(54) BACK LIGHT UNIT

(57)Abstract:

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention is used for what is used for a liquid crystal display, concerning a back light unit, and relates to effective technology.

[0002]

[Description of the Prior Art] The back light of the direct female mold or a side light method using the cold cathode tube or the hot cathode tube as a back light for TFT liquid crystal display modules is used. The brilliance control of this back light is performed by the volume for brilliance controls prepared in the personal computer.

[0003]

[Problem(s) to be Solved by the Invention] It is the color display of white, black, or at most 8 colors on one screen, and since the display using the delicate gradation difference is not performed, the conventional TFT liquid crystal display module is enough as it, even if the brilliance control of a back light unit is made to be performed by liking of an operator by the above volumes for adjustment. however, progress of liquid crystal technology in recent years -- following -- R (red) -- also in 512 color displays, a multicolor display like 4096 color displays as 16 gradation, and a monochrome display, the demand of the formation of many gradation is becoming strong as eight gradation each by each of G (green) and B (blue)

[0004] It was shown clearly by research of an invention-in-this-application person in such a multicolor display or the multi-gradation display that the following problems arose. For example, if the case where it displays only in a bright color tone is compared with the case where it displays only in a dark color tone, in displaying only in a dark color tone to the thing which may be low as for the brightness of a back light when displaying only in a bright color tone, it is not made high, and is hard to be rich and, moreover, expression of the delicate color tone between each color cannot do the brightness of a back light.

[0005] In that by which a cell drive is carried out like a notebook type personal computer on the other hand, it is required to be a low power. Since it is in the inclination which makes the brightness of a back light high in the operator having adjusted to compensate for the display of a dark color tone by volume like before, corresponding to this, power consumption also becomes large.

[0006] The purpose of this invention is to offer the back light unit which attained low-power-ization while making a screen legible. The other purposes and the new feature will become clear from description and the accompanying drawing of this specification at the aforementioned row of this invention.

[0007]

[Means for Solving the Problem] It will be as follows if the outline of a typical thing is briefly explained among invention indicated in this application. namely, an indicative data is analyzed and brightness is brightly needed at the time of a comparatively dark gradation display -- it controls and the automatic modulated light circuit controlled to make brightness dark is prepared at the time of a comparatively

bright color tone

[0008]

[Function] Low-power-ization can be attained, while being able to make a screen legible according to the above-mentioned means, since brightness can be adjusted to an optimum from the color tone of the whole screen.

[0009]

[Example] The block diagram of one example of the back light unit concerning this invention is shown in drawing 1, and it is in it. An inverter is a DC/DC inverter which a fluorescence pipe drives, in response to direct current voltage like 12V, it is high frequency like about 30kHz, generates about about 400v high voltage, and drives a fluorescence pipe. A fluorescence pipe consists of a cold cathode tube or a hot cathode tube.

[0010] In this application, although it is omitted and is in this drawing since it is not invention about the structure of a back light unit itself, the outline is as follows. The two above-mentioned fluorescence pipes are arranged in parallel with right and left so that a light guide plate may be inserted. A diffusion board is formed on the surface of a light guide plate, and the rear face of a liquid crystal display panel is put [it piles it up and] together and arranged on it. Two fluorescence pipes are put in into the reflecting plate of a semi-cylindrical shape, and when making it the reflected light face to a light guide plate, they act as the light source of a liquid crystal display panel. By adjusting the voltage supplied to the above-mentioned fluorescence pipe, adjustment of the brightness as a back light unit is enabled.

[0011] In this example, in order to make it become a low power moreover the optimal according to the screen where the brightness of the above-mentioned light source is displayed, an automatic modulated light circuit is prepared. This automatic modulated light circuit receives color tone data from the personal computer as a source of a signal, forms a control signal which stops low the brightness in a color tone with the bright average of the whole screen, and forms a control signal which sets up brightness highly, if it is a dark color tone. the kind of the above-mentioned control signal is bright to everything but two kinds -- a somewhat bright somewhat dark dark thing -- you may make it increase to four etc. kinds [like] etc. Since the automatic regulation of the brightness of a back light unit is carried out according to such the display screen, a screen can be made legible, and since the brightness of a back light unit is stopped at the time of a bright screen, it can be made a low power.

[0012] The relation of the permeability of a signal level and liquid crystal is shown in drawing 2. The signal level to which the luminosity of eight gradation specifies the gradation to be this drawing at a vertical axis is shown in the horizontal axis. Since a vertical axis is a logarithm when the brightest gradation 0 (the case of monochrome the case of white and color display color of the primary color) is made into 100% of permeability, although 50% and gradation 2 become as large [gradation 1] as 2%, they are sensed most automatically [such a big gradation difference] by human being's eye.

[0013] Therefore, by having used the back light of the brightness same at the display screen using gradation 4, 5, and 6 and the dark gradation of 7 grades, and the display screen using gradation 0, 1, and 2 and the bright gradation of 3 grades chiefly, the luminosities of the display screen will differ greatly chiefly.

[0014] Since the above-mentioned signal level decodes a color tone indicative data and is formed, it can judge about the thing corresponding to which gradation the average of the whole screen is by calculating the data corresponding to ***** arithmetically and calculating the average. An automatic modulated light circuit performs such an easy operation, and forms the above intensity-control signals. The above averages prepare the easy D/A-conversion circuit besides what is performed by the digital arithmetic circuit, and can also carry out it as [ask / in analog / supply the output to the integrating circuit which consists of a capacitor and resistance, and / for it].

[0015] The control signal formed of the above-mentioned automatic modulated light circuit may be compounded with the adjustment signal formed by volume of operation of an operator, may control an inverter, and may adjust the brightness of a fluorescence pipe.

[0016] The operation effect acquired from the above-mentioned example is as follows. (1) an indicative data is analyzed and brightness is brightly needed at the time of a comparatively dark gradation display -

- by preparing the automatic modulated light circuit which is controlled and is controlled to make brightness dark at the time of a comparatively bright color tone, since brightness can be stopped at the time of a bright color tone while being able to make a screen legible, the effect that a low power can also be attained is acquired [namely,]

[0017] Although invention made from this invention person above was concretely explained based on the example, it cannot be overemphasized by the invention in this application that it can change variously in the range which is not limited to the aforementioned example and does not deviate from the summary. For example, the number of cold cathode discharge tubes may be three or more. The composition of the light guide plate which constitutes a back light unit, a diffusion board, and a reflecting plate can take various operation gestalten. A liquid crystal display panel can be widely used as a display of various electronic instruments besides display units, such as various microcomputers. This invention can be widely used as a back light unit of a liquid crystal display panel which performs multiple color or a multi-gradation display.

[0018]

[Effect of the Invention] It will be as follows if the effect acquired by the typical thing among invention indicated in this application is explained briefly. namely, an indicative data is analyzed and brightness is brightly needed at the time of a comparatively dark gradation display -- by preparing the automatic modulated light circuit which is controlled and is controlled to make brightness dark at the time of a comparatively bright color tone, since brightness can be stopped at the time of a bright color tone while being able to make a screen legible, a low power can also be attained

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CLAIMS

[Claim(s)]

[Claim 1] in response to an indicative data, brightness is brightly needed at the time of a comparatively dark gradation display -- the back light unit which is equipped with the automatic modulated light circuit direct and it is directed that makes brightness dark at the time of a comparatively bright color tone, and is characterized by the bird clapper

[Claim 2] The back light unit equipped with the above-mentioned automatic modulated light circuit is a back light unit of the claim 1 characterized by being what used for the TFT liquid crystal display module formed into many gradation with multiple color.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing one example of the back light unit concerning this invention.

[Drawing 2] It is a property view for explaining the permeability for explaining liquid crystal display operation, and the relation of a signal level.

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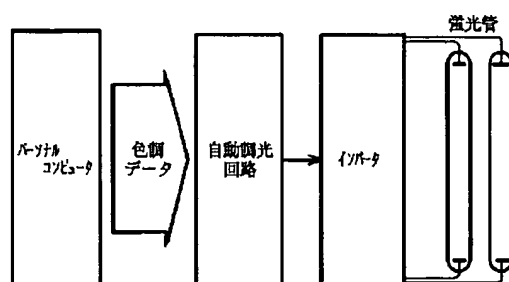
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DRAWINGS

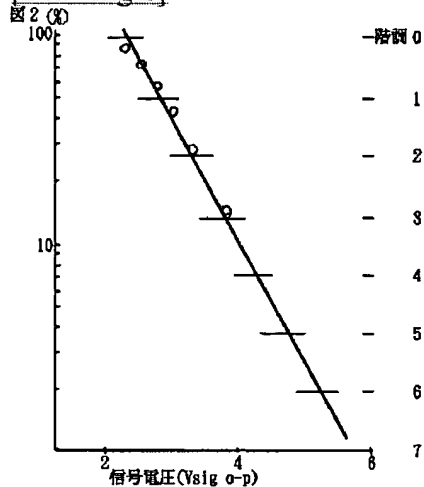
[Drawing 1]

図1



[Drawing 2]

図2 (a)



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